Benefits of Multiple Conservative Water Quality Constituents in Historical and Forecast Simulations

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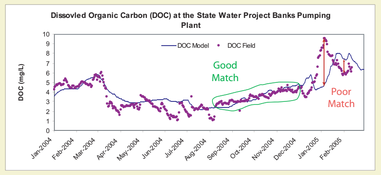
The Problem

Improving Water Quality Models



Model skill is the ability of a model to accurately represent field data.

Given that sometimes modeled water quality will match field data well and other times it will match field data poorly, how can we improve *model skill*?

One Solution (Methodology)

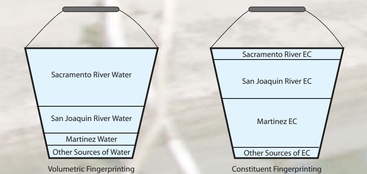
By comparing what the model simulated correctly with what the model missed, we can eliminate some of the possible sources of error. For any given time or location *fingerprints* show how much each source of water contributed to the total and which sources are most significant.

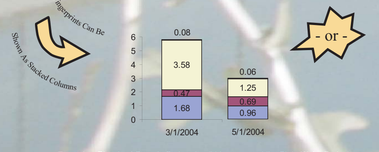
What is a water quality "fingerprint"?

A water quality *fingerprint* can be described as collecting a bucket of water at a given location and then labeling how much of the water or a particular constituent (such as salt or organic carbon) in the bucket came from different sources.

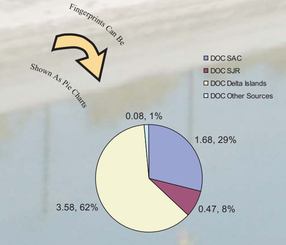
At a specific time and location, two primary types of fingerprinting questions can be asked:

- ❑ How much of the water came from each soure?
  This is known as *Volumetric Fingerprinting*.
- ❑ How much of a particular parameter or constituent came from each source?
  This is known as *Constituent Fingerprinting*.





- or -

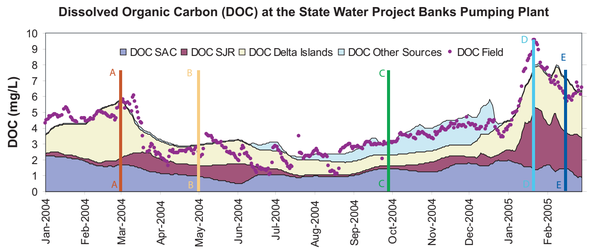


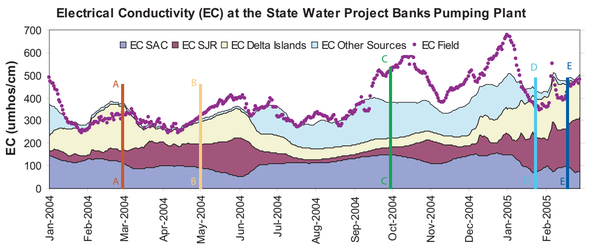
Example: Dissolved Organic Carbon (mg/L) by source at the State Water Project Banks Pumping Plant on March 1, 2004 (A-A).

Examples: Dissolved Organic Carbon (mg/L) by source at the State Water Project Banks Pumping Plant on March 1 (A-A) and May 1, 2004 (B-B).

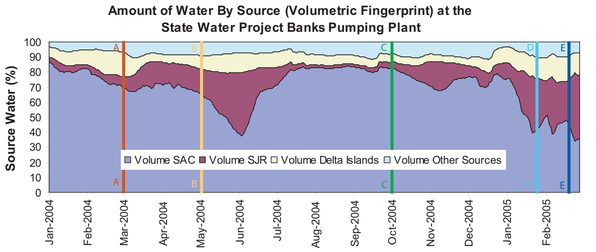
Fingerprint Examples at the State Water Project's Banks Pumping Plant

Conservative Constituent Fingerprints

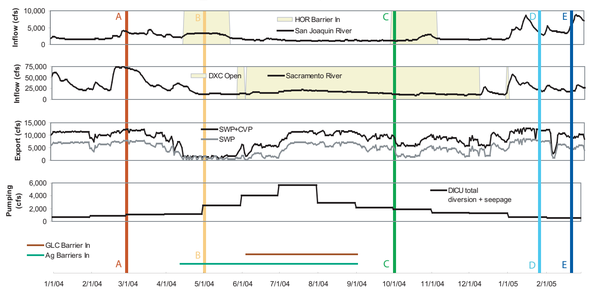


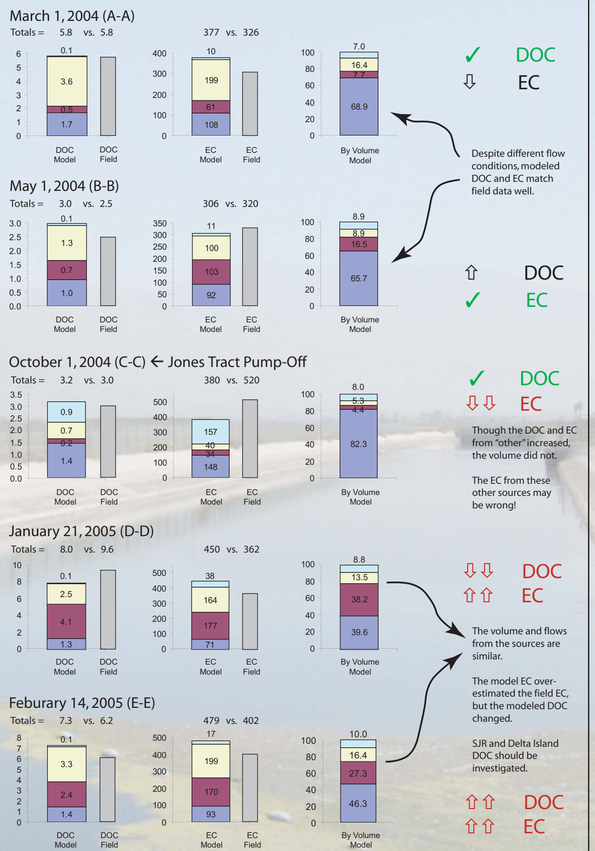


Volumetric Fingerprints

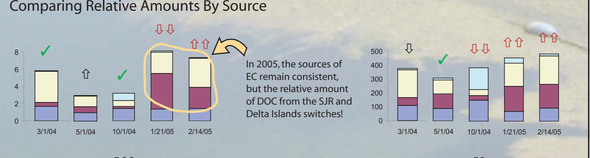


Hydrodynamic Summary





Comparing Relative Amounts By Source



In 2005, the sources of EC remain consistent, but the relative amount of DOC from the SJR and Delta Islands switches!

Why "Conservative" Constituents?

This methodology only works with *conservative* water quality constituents. A *conservative constituent* does not interact with other water quality parameters. With *conservative constituents*, the differences between model and field data are directly related to the accuracy of the source water concentrations and flows.

Important Considerations

- ❑ We can be right for the wrong reasons, but the greater number of locations and conservative constituents we use to analyze water quality behavior in the Delta, the better our skill of correctly modeling the Delta water quality becomes.
- ❑ The Delta inflow concentrations change and should be examined along with the fingerprints and hydrodynamics information. Errors in a model's water quality boundary assumptions can be part of the reason that the model might differ from the field data.

Example Applications

Although it is not standard procedure to analyze volumetric and constituent fingerprints in all modeling anlyses, there are several examples where fingerprints have been useful in improving our understanding of the Delta:

- ❑ In-Delta Storage Studies
- ❑ MWQI Real-Time Data and Forecasting Project
- ❑ 2004 Jones Tract Levee Break and Flooding
- ❑ D-1641 Brandt Bridge Historical Salinity Analysis
- ❑ Pelagic Organism Decline Hydrodyanmic Investigations

Ask Me About These

Acknowledgments

- ❑ DWR's Municipal Water Quality Investigations (MWQI) Program
- ❑ Rob DuVall
- ❑ Jamie Anderson

Additional Info?

Water Quality Fingerprinting with DSM2:

- ❑ Web Info: *http://modeling.water.ca.gov*
- ❑ Email Contact: Michael Mierzwa, *mmierzwa@water.ca.gov*

MWQI Real-Time Data and Forecasting Project:

- ❑ Email Contact: Rob DuVall, *rduvall@water.ca.gov*